ES 202 Fluid & Thermal Systems Exam 2

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Problem	Score
1	/40
2	/25
3	/35
Total	/100

Show all work for credit Open book - Fluids (White) and Thermo (Wark & Richards)

- 1. (40 points) Kerosene at 20°C is pumped through a new stainless steel pipe of diameter of 12.7 mm (0.5 inches). The 180° elbow has a "regular" radius and is screwed onto the straight pipes. The length of the elbow is negligible compared to the length of the straight pipe. The velocity of the kerosene is 15 m/s. Assume the flow is steady and incompressible, and has negligible change in elevation.
 - a. (30 points) Find the pressure drop p_1 - p_2 (kPa) due to friction in the pipe.
 - b. (10 points) Find the pump power (kW) required for this flow. Assume V=15 m/s and $p=p_{atm}$ at the pump inlet.



- 2. (25 Points) Use water (i.e. H_2O) for the following problems.
- a. Given: p=300 kPa, x=0.4 Find: phase, T, v

b. Given: p=150 kPa, T=60 °C Find: phase, v, h

c. Given: p=50 kPa, h=3356 kJ/kg Find: phase, T, v

d. Plot and label these 3 points on the p-v diagram below.



3. (35 points) Refrigerant 134a flows steadily through the nozzle shown below.

- a. (30 points) Find the exit temperature T_2 .
- b. (5 points) Find the exit diameter D_2 .

